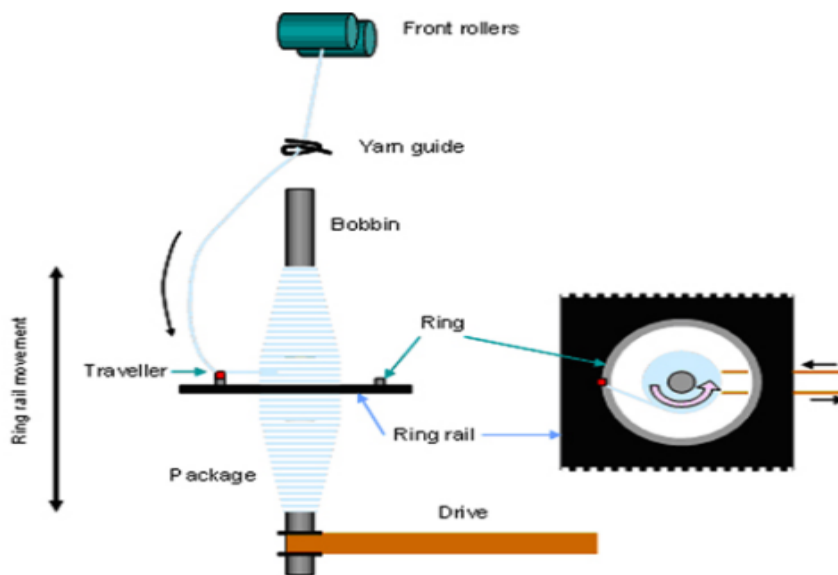


Spinning and ginning operation

Level-II

Based on March 2022, Curriculum Version 1



Module Title: - Performing spinning operations

Module code: IND GSO2 M06 0322

Nominal duration: 80 Hour

Prepared by: Ministry of Labour and Skill

August, 2022

Addis Ababa, Ethiopia

Table of Content

Acknowledgment.....4

Acronym	5
Introduction to the module	6
Unit one: Set up and load machine.....	7
1.1 OHS practices	8
1.2 Production specifications	9
1.3 Machine settings and adjustment	10
1.4 Yarn production process	11
1.5 Quality of yarn	12
Self check-1	13
Operation sheet-1	14
Lap Test-1	15
Unit Two: Operate and monitor spinning machine	16
2.1 Operation of spinning machine	17
2.1.1 Ring (Conventional) Spinning.....	17
2.1.2 Open-End Spinning	18
2.1.2.1 Rotor system	18
2.1.2.2 Friction system	19
2.2 Monitoring spinning machine operations	20
2.2.1 The Ring Spinning Process	20
2.2.2 Functions of the Ring Spinning Frame	21
2.2.3 The Rotor Spinning Process.....	25
2.3 Sorting production wastes.....	31
2.4 Yarn faults.....	33
Self check-2	35
Operation sheet 2	36
Lap Test-2.....	37
Unit Three: Check product quality	38
3.1 Spinning product parameters	39
3.1.1 Yarn parameters the different parameters of yarn are given below:	39
3.2 Product faults and non-conformances	43
3.3 Correction of product fault.....	48
Self check-3	49
Operation sheet-3	50
Lap Test-3.....	51
Unit Four: Complete operations.....	52
4.1 Principles of doffing and replacing	53
4.2 Product handling and dispatching system	53
4.3 Production records and documentation	54
Self check-4	56
Operation sheet-4	57

Lap Test-4	58
Reference	59

Acknowledgment

Ministry of Labor and Skills wish to extend thanks and appreciation to the many representatives of TVET instructors and respective industry experts who donated their time and expertise to the development of this Teaching, Training and Learning Materials (TTLM).

Page 3 of 54	Ministry of Labor and Skills Author/Copyright	Performing spinning operation	Version -1
			August, 2022

Acronym

TTLM: teaching, training, learning material

TVET: technical vocational education and training

SOP: standard operating procedure

OHS: occupational health and safety

Page 4 of 54	Ministry of Labor and Skills Author/Copyright	Performing spinning operation	Version -1 August, 2022
--------------	--	-------------------------------	----------------------------

OE: open end

TPI: turns per inch

BCR: balloon control ring

PPE: personal protective equipment

HVI: high volume instrument

Introduction to the module

In textile ginning and spinning occupation, Spinning is the process of conversion of textile fibers and filaments into yarns for weaving or knitting into fabrics. It is essential for the production of quality product. And also spinning operation is the base for the quality standard and specification to produce textile products.

This module is designed to meet the industry requirement under the ginning and spinning occupational standard, particularly for the unit of: machine set up and load and spinning machine operation and monitor

This module covers the units:

- machine set up and load
- spinning machine operation and monitor

- product quality check
- Completing operations

Learning Objective of the Module

- Apply machine set up and loading
- Perform operation of spinning machines
- Check product quality
- Complete operation

Module Instruction

For effective use this modules trainees are expected to follow the following module instruction:

1. Read the information written in each unit
2. Accomplish the Self-checks at the end of each unit
3. Perform Operation Sheets which were provided at the end of units
4. Do the “LAP test” giver at the end of each unit and
5. Read the identified reference book for Examples and exercise

Unit one: Set up and load machine

This unit is developed to provide you the necessary information regarding the following content coverage and topics:

- OHS practices
- Production specifications
- Machine settings and adjustment
- Yarn production process
- Quality of yarn

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Apply OHS practice
- Determine and follow production specification
- Determine and apply machine settings and adjustment
- Understand yarn production process
- Determine quality of yarn





Includes regulatory and legislative requirements, and licensing and environmental requirements, and may relate to:

- Standard operating procedures
- Personal protective equipment
- Safe materials handling
- Ergonomic arrangement of workplaces
- Safe storage of equipment
- Housekeeping and environmental practices
- Reporting accidents and incidents

Workplace personal protective equipments /PPE/

Personal protecting equipment's are any materials that are used to cover body parts to protect the worker from different disease causing organisms, direct sun radiation and any other physical damages. This equipment's may be provided by purchasing from markets or by making from local materials.

The following are some of personal protecting materials

No	Materials	Description
1		Body safety cloth (tuta): - This cloth is a type of cloth which covers all the body part except the head and the fingers. It is used to protect the body from dirty.
2		Sun hat:- is the material, that is used to protect head from direct sun radiation
3		Eye protecting device: - it is used to protect the eye from different damages
4		Boot:- it is used to protect leg from sharpen and other damaging


5		Hand glove: - which is made of leather or strong flexible plastic rubber, it used to cover fingers to protect from sharpen materials.
---	---	--

Table1. PPE

1.2 Production specifications

Identify necessary specification for product

Spinning can be divided into the following three basic operations:

1. Attenuation (drafting) of the roving or sliver to the required linear density
2. Imparting cohesion to the fibrous strand, usually by twist insertion
3. Winding the yarn onto an appropriate package.

Specification may include:-

- Count
- Twist
- Tension and weight
- Lubrication
- Twist direction
- Strength and
- □Extension

Frequently used yarn characteristics

Fiber type and content	Yarn Strength
Yarn type	Yarn Elongation
Yarn structure	Friction Coefficient
Yarn count (Linear density)	Neps count
Yarn twist	Yarn Bulk
Yarn evenness (Thick and thin places)	Yarn Finish
Yarn Texture (Texturizing process, crimp structure)	Yarn hairiness

1.3 Machine settings and adjustment

Machine settings are adjusted to meet product requirements. Safe working practices are understood and implemented. Machine is set in accordance with defined procedures. Machine is adjusted to meet specifications and operational requirements and first-off samples are measured for compliance with specifications.

Machines may include:-

- Ring frame machines
- Open end machines

Setting of machines according to product requirements like:-

- count
- twist
- Ply
- Tension
- Weight
- Lubrication
- twist direction
- strength
- Extension
- Hank/count

Machine setting is adjusted for product requirement

- Machine is started and stopped in accordance with manufacturer requirements. Machine operations are monitored to ensure correct operation.
- Waste is sorted according standard procedure. Machine is cleaned when required.
- Product process and machine faults are identified and corrected where necessary to meet specified requirements:-

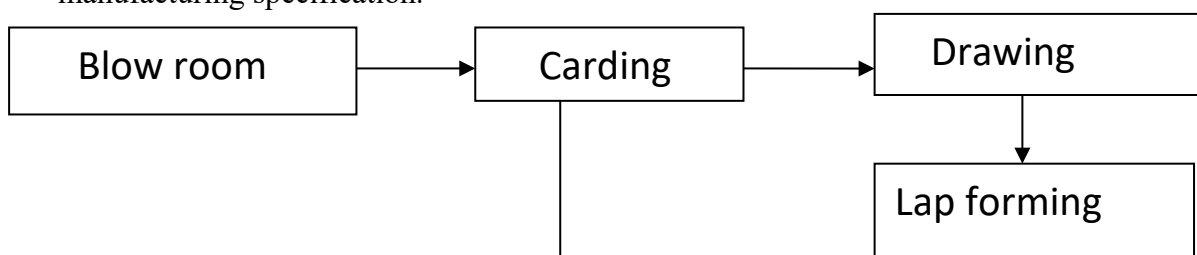
Machine operations may include:-

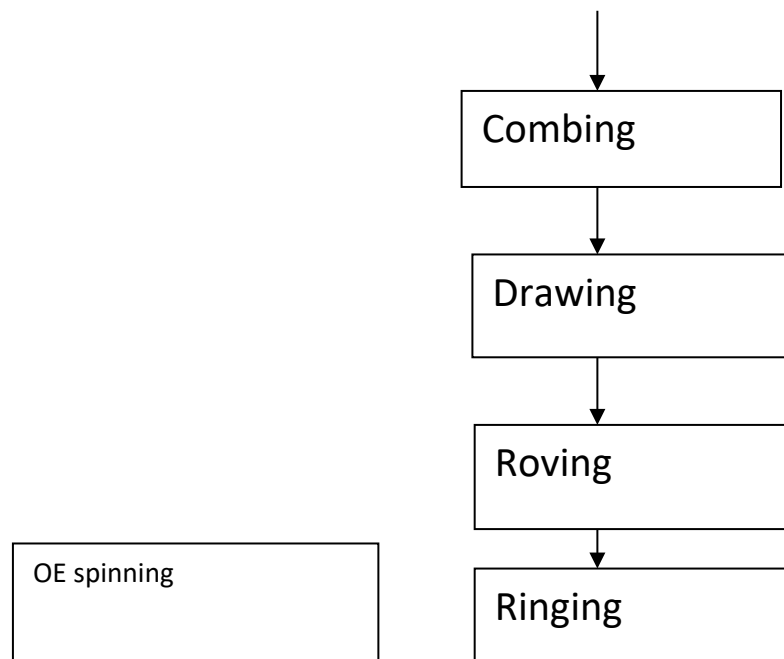
- Drafting
- Twisting
- Splicing
- Piecing up, joining and Fault identification

1.4 Yarn production process

Sequence of Spinning Process:

Spinning: The process of making yarns from the textile fiber is called spinning. Spinning is the twisting together of drawn out strands of fibers to form yarn. Product specification for spinning machines varies according to the type of machine, product standard and manufacturing specification.





1.5 Quality of yarn

The quality of yarn is determined by the constituent fibre properties that can be used to forecast partially the physical properties of yarn and the success of spinning. The quality of yarn and the associated testing of those yarn properties will determine the yarn quality and are crucial to meet yarn requirements for subsequent fabric manufacturing and end product. The ring spinning system is considered a crucial process in producing yarns due to its flexibility and high quality of yarns produced which are considered by most yarn producers to have ideal structure and parameters

Some quality parameters of yarns are:-

- count
- Evenness

- Elongation
- Tensile strength
- Yarn uniformity
- Hairiness
- Imperfection
- TPI

Most of the mills use high-speed winding machines to wind the yarn. This process results in some changes in yarn quality such as yarn imperfections, hairiness, seldom occurring faults etc. due to the use of various guides, yarn clearers etc. on the machines

The yarn quality is largely influenced by the fibre properties. Generally longer and finer fibers are used for finer counts

Quality level of the yarn is appreciated from different points of view depending on the market and the end use.

Self check-1

Test I: Choice

Instruction: write choice answer for the given question. You are provided 3 minute for each question and each point has 3 Points

1. The followings are the basic operations of spinning except?
A, twisting B, winding C, cleaning D, attenuation
2. Which one of the following is not protective equipment?
A, goggle B, tuta C, glove D, yarn

Test II: short Answer writing

Instruction: write short answer for the given question. You are provided 3 minute for each question and each point has 5Points

1. What are OHS practices?
2. Write the product specifications in spinning.
3. Draw the flow chart of spinning operation.
4. List at least 10 quality parameters of spinning

Note: Satisfactory rating – above 60% Unsatisfactory - below 60%

You can ask your teacher for the copy of the correct answers

Operation sheet-1

OPERATION TITLE: Set up and load machines.

Instruction Use the given, the tools and equipment, machineries set up and load machines.

For this operation you have given 1 Hour and you are expected to provide the operation

PURPOSE: To understand and perform about the way of setting and loading spinning machines.

EQUIPMENT TOOLS AND MATERIALS:

- safety tools like glove, goggle safety boot
- open end spinning ,
- ring spinning ,

PROCEDURE:

Step 1: Read the information sheet well

Step 2: Apply OHS practices

Step 3: Follow the steps for machine set up and load

Step 4: Follow standard operating procedures for set up and load

Step 5: Set up and load machines according to specification and manufacturer requirement.

Step 6: Report faults and non conforming materials or problems

Step 7: Clean the area and handle the waste properly

PRECAUTIONS:

- Use of proper OHS materials
- Must apply Operational workplace activities
- Use Restricted space
- Hazardous, controlled or exposed conditions
- Work may be conducted in small to large scale enterprises and may involve individual and team activities.

QUALITY CRITERIA:

The machines are set up and load properly as per the specification.

Lap Test-1

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, workshop, tools and materials you are required to perform the following tasks within 3 hours.

Task 1: Adjust machines setting as per product.

Task 2: Load raw materials to spinning machines according to requirements

Task 3: Prepare report on production faults and other non conforming materials.

Task 4: Clean the area around the machine during setting and loading.

Unit Two: Operate and monitor spinning machine

This unit to provide you the necessary information regarding the following content coverage and topics:

- Operation of spinning machine
- Monitoring spinning machine operations
- Sorting production wastes
- Yarn faults

This guide will also assist you to attain the learning outcomes stated in the cover page.

Specifically, upon completion of this learning guide, you will be able to:

- Operate spinning machines
- Monitor spinning machineries
- Sort production wastes
- determine yarn faults

2.1 Operation of spinning machine

2.1.1 Ring (Conventional) Spinning

Page 15 of 54	Ministry of Labor and Skills Author/Copyright	Performing spinning operation	Version -1 August, 2022
---------------	--	-------------------------------	----------------------------

Ring spinning is a process that converts the short, raw fibre into a continuous yarn using a series of machines, as shown in Figure 2.1 the conventional systems for converting staple fibre into spun yarns are those developed for cotton and wool: opening, carding, and drawing, combing, roving and spinning.

- **Opening:** This is the first operation in the spinning of yarn from raw fibres. Opening is the basic process of reducing the tuft size of the compressed cotton fibres from a bale into smaller fibre tufts. It removes the particles of dirt, dust and other impurities from the cotton tufts by using spiked rollers. After this process the fibre will be transferred to another process.

- **Carding:** After mixing (blending) and opening, loose fibres are transferred to a carding machine. Carding is performed by opposing sets of teeth or small wire hooks known as card clothing, which cover the machine parts and include a licker-in, a cylinder, revolving flats and a doffer. The cylinder and the flats may rotate in the same or opposing directions but at different speeds to tease the fibre tufts into a thin, filmy web, which is then collected into a loose ropelike structure called a sliver, which is often coiled, and deposited in cans. Carding further opens the fibre tufts and extracts any fine particles, neps and short fibres enclosed by the fibre aggregates.

The drawing frame uses a series of rollers arranged in pairs and rotating at different speeds. Slivers are passed between the rollers and combined. The fibres will be well parallelised and mixed after going through this process.

- **Combing:** Combing is the basic process of reducing the tuft size of the compressed cotton fibres from a bale into smaller fibre tufts. A roller with fine-toothed elements fixed on a half-lap is used. The amount and length of the short fibres extracted will depend on the combing parameters selected. The fibres will be straightened and paralleled during this process.

- **Roving:** In this process, slivers are reduced to around one-eighth of their original diameter by three pairs of rollers, rotating at different speeds. The required level of twist is also imparted to keep the rovings stable under the stretching caused by winding and unwinding.

- **Ring spinning:** The conversion of roving in to yarn is called the spinning process. This is usually done in a roller drafting system that will have some means of fibre control, such as a double apron. Twist is imparted to the fibre strands to prevent slippage through the ring and traveler. The yarn is then wound onto suitable bobbins known as ring cops for further processing.

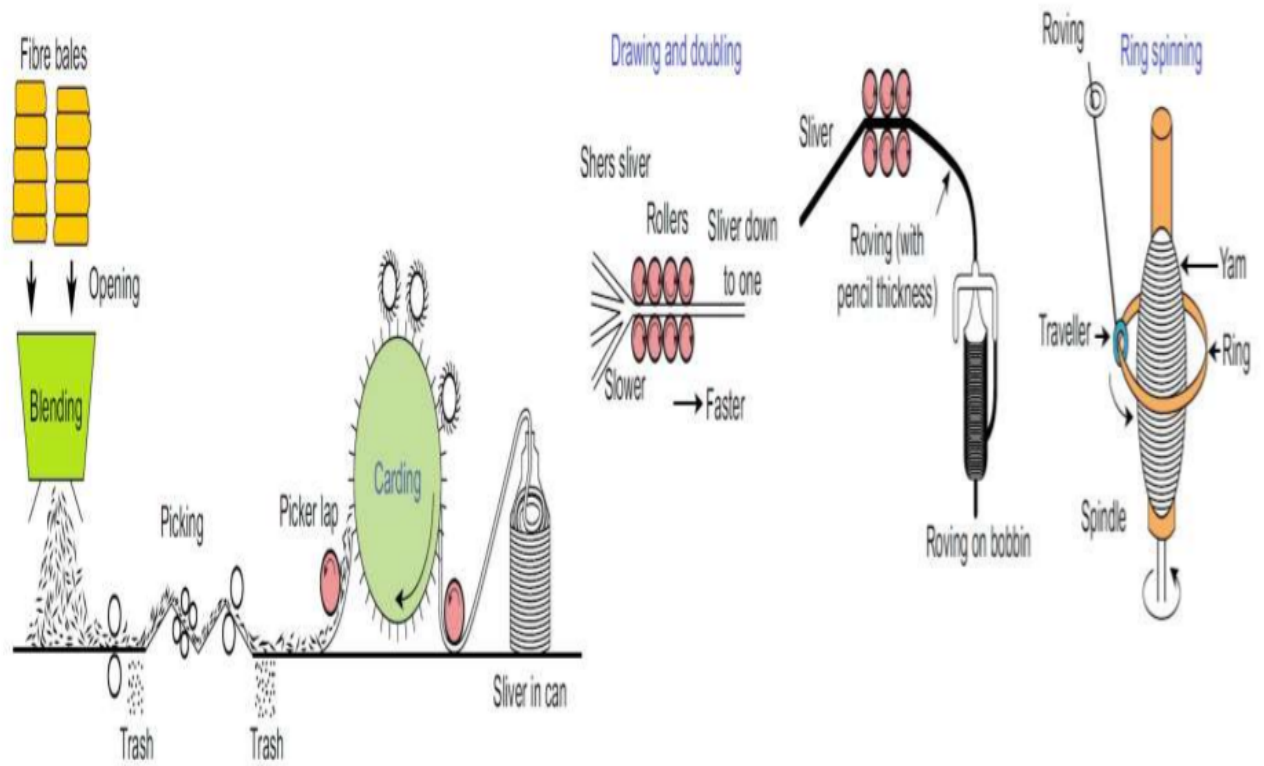


Figure 2.1 Process flow chart of conventional ring-spinning process

2.1.2 Open-End Spinning

There are two commonly used yarn manufacturing methods operating on the open-end spinning Principle: rotor and friction. The rotor system is mainly used for the production of course to Medium count short staple yarns. The friction system is used mainly to make coarser industrial yarns. However, both systems may also be used for making some fancy yarns.

2.1.2.1 Rotor system

In open-end spinning, the yarn twisting action is separated from the winding action and the package needs to rotate only at a relatively low winding speed. The process may be divided into the following steps: opening, transport, alignment, over lapping and twist insertion. In the rotor-spinning process, as shown in Figure 1.20, individual fibres are carried into the rotor on an air stream and laid in contact with the collecting surface so that a strand of fibres is assembled around the circumference. As the fibres are drawn off, twist is imparted by the rotor, to produce a yarn. Rotor spinning is most suitable for spinning short staple-fibre yarns. Recent developments in electronic control have allowed the development of rotor spinning machinery that is also capable of producing slub yarns. These yarns are used in furnishings and drapes, rather than in apparel fabrics, although they are sometimes used in denim fabrics.

They are manufactured using attachments to ordinary open-end spinning devices, which usually incorporate an electronically controlled device for the brief acceleration of the drawing-in roller. As a result of the back doubling action inside the rotor, it is not possible to produce slubs shorter than the circumference length of the rotor because any variation in the fibre feed material is spread over a minimum length of the rotor circumference.

There have also been attempts to alter the fibre flow and thus introduce variations in the yarn appearance by the use of injecting pressurized air into the fibre-transportation tube. However, the effects created using this approach are very limited, as the fibre flow in the transportation tube is slight and the variation in the yarn caused by changes in the airflow is therefore very small.

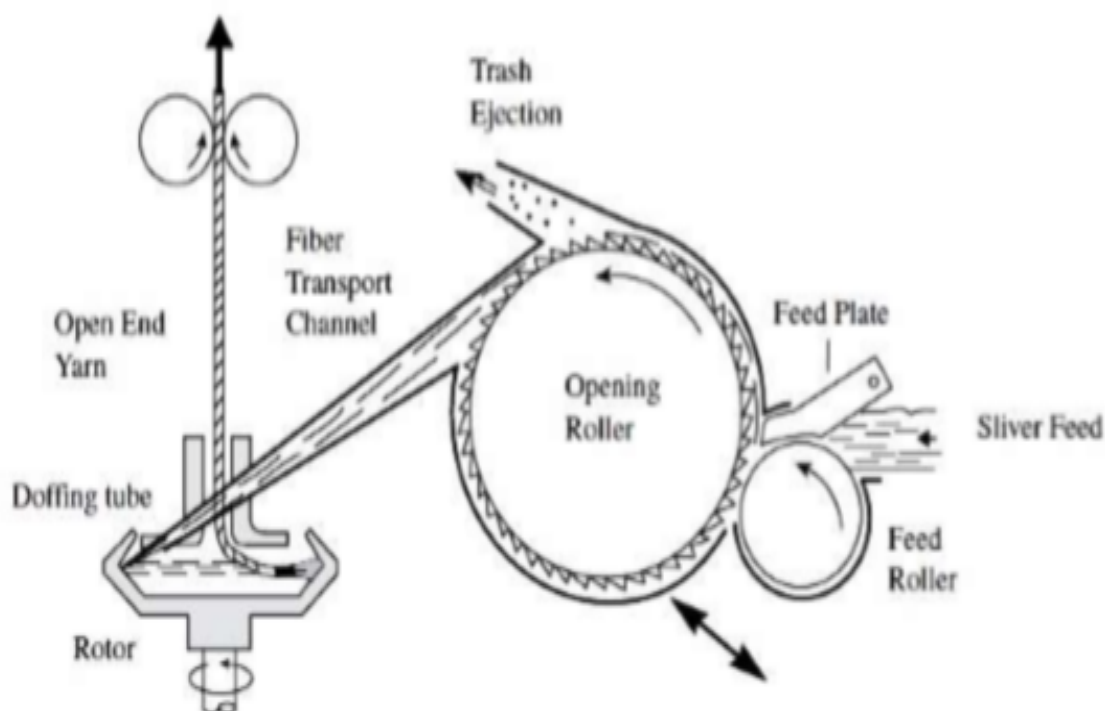


Figure 2.2 Schematic diagrams on the Principle of rotor spinning.

2.1.2.2 Friction system

Friction spinning is a different open-end spinning technique when compared to rotor spinning. Instead of using a rotor, two friction rollers are used to collect the opened-up fibres and to twist them into yarn. The principle of DREF-2 is shown in Figure 2.3. The company also produces the DREF 3 machine, which has an extra drafting unit in the machine in order to feed drafted staple fibres to form a core component. The fibres are fed in sliver form and are opened by the opening roller. The opened fibres are then blown off the opening roller by an air current and transported to the nip area of two perforated friction drums. The fibres are

drawn onto the surfaces of the friction drums by air suction. The two friction drums rotate in the same direction, and twist is imparted to the fibre strands because of the friction with the two drum surfaces.

The yarn is withdrawn in the direction parallel to the axis of the friction drums and is delivered to a package-forming unit. A high twisting speed can be obtained even while using a relatively low speed for the friction drums, because the friction drum diameter is much larger than that of the yarn.

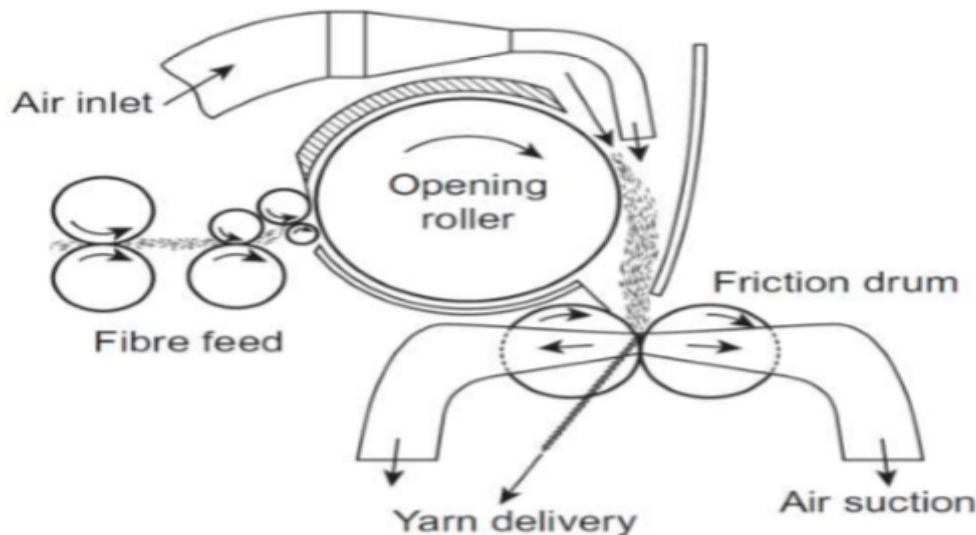


Figure 2.3 Schematic diagrams on the Principle of friction spinning

2.2 Monitoring spinning machine operations

2.2.1 The Ring Spinning Process

The ring spinning is the final operation in the formation of the ring spun yarn. The basic purpose of the ring spinning frame is to attenuate the roving until the required fineness of the yarn is achieved.

The basic requirements and functions of a ring-spinning frame are:

- fibre supply,
- Drafting,
- Twisting, and
- Package winding.

The fibre supply, usually in the form of roving and having a hank* range from approximately 0.40 to 5.0 is drawn into the drafting system by the rotation of the back rolls. In the drafting zone, the weight per unit length of the input roving is reduced because the surface speed of the front drafting rolls is greater than that of the back rolls. Normal ring frame drafts range up to The front rolls deliver a continuous cohesive stream of fibres, which must be twisted

immediately into yarn. This transformation is accomplished by the interactions of the spindle, ring and traveler. The rotation of the spindle causes twist to be inserted into the stream of fibres delivered by the front rolls. By passing the yarn under the traveller, winding is accomplished.

2.2.2 Functions of the Ring Spinning Frame

The basic function of the ring spinning frame is drafting. Drafting is carried out to such an extent so as to achieve desired fineness of the yarn. The drafting is carried out by using a 3 over 3 roller drafting arrangement with double apron support. At the ring spinning frame a draft of 15 to 40 is given (sometimes also up to 50).

The attenuated yarn formed by drafting is weak and lack cohesion. In order to give strength to the final yarn, twist is inserted. Twist is inserted at the ring spinning frame by using the popular traveller method. The amount of twist inserted in the yarn varies with the count of the yarn. To make finer yarns, greater TPI is given and vice versa. The value of Twist Multiplier (TM) at the ring spinning frame generally ranges from 3 to 5.

The final yarn produced after drafting and twisting is wound on special ring bobbins also called as cops. The built of the package kept is such which is suitable for storage, transportation and further processing. The ring spinning frames are double sided or double delivery machines having up to 500 delivery points or spindles on each side. Hence a single machine can have a capacity of up to 1000 spindles.

A typical ring spinning frame can be divided into the following four zones:

- Creel Zone ,
- Drafting Zone
- Twisting Zone,
- Package Winding Zone

Creel Zone

The creel of the ring spinning frame is a simple device that holds the roving. It is very important that the roving should unwind properly and evenly to avoid any false drafts or roving breakages. To facilitate proper unwinding the roving bobbins are held vertically by inserting the roving bobbin on the bobbin holder placed at the upper portion of the frame.

Drafting Zone

Since the at the ring spinning frame greatest value of draft is given, the drafting zone of the ring frame is the most important part of the machine that directly influences the evenness and

strength of the yarn. So it is important to have a precision control on the fibres in the strand which is being drafted out to suppress the drafting waves.

Twisting Zone

The yarn leaving the front pair of drafting rollers is threaded through a guide also called as the lappet guide that is placed directly over the spindle axis. The yarn then passes through a traveller on to the yarn package (cop). The traveller is mounted on the ring encircling the spindle. The cop is mounted on the spindle and rotates with the spindle. When the cop rotates the tension on the yarn pulls the traveller to rotate around the ring. Due to the friction created between the traveller and the ring and also due to the air drag created by the balloon formation at the winding section, the rotary and surface speed of the traveller is slightly less than that of the spindle and is given by: $\text{RPM of Traveller} = \text{RPM of Spindle} - \frac{\text{Delivery Speed}}{\pi \times \text{Package Dia}}$

So in one rotation of the traveller one twist is inserted in the yarn. Since the difference between traveller and spindle rotary speed is very small so this difference is ignored. Thus for calculating twist rotary speed of the spindle is considered, mathematically:

$$\text{T.P.I} = \frac{\text{Rotary Speed of Spindle (rpm)}}{\text{Delivery Speed (inches/min)}}$$

The ring/traveller arrangement and the spindle are also very important elements of the ring spinning frame because it not only helps to insert twist in the yarn but also helps in the winding of the package. So, in the ring spinning drafting arrangement the front top roller is deliberately kept 2-4 mm forward relative to the bottom front roller while the middle top roller is kept 2-4 mm backward relative to the middle bottom roller. This type of arrangement gives smooth running of the top roller and helps to reduce spinning triangle and ultimately the breakage rate during the spinning process is reduced.

The ring/traveller arrangement and the spindle are also very important elements of the ring spinning frame because it not only helps to insert twist in the yarn but also helps in the winding of the package

The Ring

The rings are supported on the raise-able and lower-able ring rail. The ring should have a tough, hard and smooth surface. For this purpose flame hardened steel, nitrided steel, carbonitrided steel and chrome steel is used. The hardness of the traveller should be less than that of the ring so that wear mainly occurs on the traveller which is cheaper and easier to replace.

The Traveller

The traveller is an important element of the ring frame as it imparts twist on the yarn and also helps in winding the yarn on the cop. The traveller does not have a drive of its own but is

dragged along with the yarn as it gets wound on the cop due to the rotating spindle. As the traveller moves at a high speed on the ring it creates lot of friction that generates significant amount of heat. So in order to cope up with such frictional forces the material used for traveller should exhibit the following properties:

- Generate as little heat as possible.
- Should dissipate heat quickly to the ring and the air.
- Should be elastic so that it might not break.
- Should have high wear resistance.
- Should have less hardness than the ring.

To meet these requirements, the traveller is made exclusively of steel having its surface either electroplated with nickel and silver or treated with chemicals to increase wear and reduce friction.

Different types and varieties of yarns cannot be spun using a single type of traveller. Therefore travellers come in many different varieties. The differences among travellers are found in shape, mass, wire profile and yarn clearance.

Mechanically speaking, the production of a ring frame is limited by excesses in one or more of the following:

- a) Spindle speed,
- b) Front roll speed,
- c) Traveler speed,
- d) Frame down-time for doffing.

Package Winding Zone

The yarn after being twisted by the traveller has to be properly wound on the entire length of the package called as the cop. In order for the winding to take place there should be a difference in the surface speed between the spindle and the traveller. The traveller has no drive of its own instead it is carried along with the yarn which is being wound on the cop after passing through the traveller. The frictional forces between the spindle and the traveller and also the air drag because of the balloon formation between the lappet guide and the spindle makes the surface speed of the traveller less than that of the spindle. This automatically fulfils the requirement of winding. The traveller and the spindle cooperate with each other to perform winding. In order for the yarn to be properly wound on the entire length of the cylindrical ring bobbin (cop), the ring is raised and lowered which is mounted on a longitudinal ring rail.

The Spindle

Page 22 of 54	Ministry of Labor and Skills Author/Copyright	Performing spinning operation	Version -1 August, 2022
---------------	--	-------------------------------	----------------------------

Spindle is a very important component of the ring frame; it not only supports the cop and helps in winding of the yarn on it but also gives motion to the traveller. The spindle and the traveller therefore work in close cooperation with each other to perform both twisting and winding.

A spindle is a metallic shaft that holds the yarn package or cop.

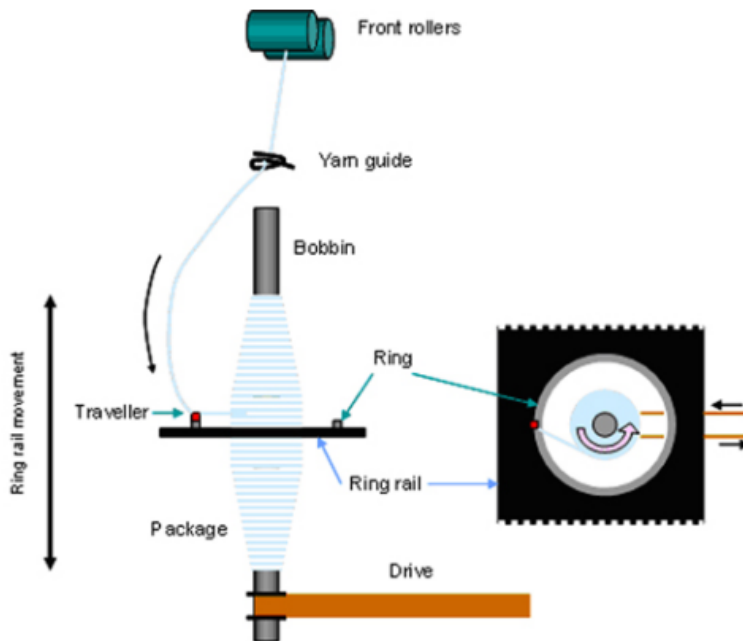


Figure 2.4 single spindle operation diagrams

Use of Balloon Control Rings (BCR)

To achieve greater production speeds with minimum friction produced by the traveller, the Spindle and the rings used on modern ring frames are comparatively small. This small ring size only permits a very limited length of yarn to be wound on the bobbin and the doffing would have to be performed more frequently and hence the productivity would suffer. On modern machines this problem has been overcome by using longer length of spindles and bobbins so that even with less package diameter more yarn length can be wound. This reduces the amount of doffing and productivity can be increased in this way.

Ring spinning also has several major limitations. These limitations include:

- High power consumption
- Small package size
- Low production rate

2.2.3 The Rotor Spinning Process

In the production of short staple spun yarn, the rotor spinning technique is an excellent modern alternate to the old classical ring spinning method due to its high productivity advantage over the ring spinning. The rotor spinning is not only highly productive but also very cost effective at the same time. In addition to short staple spinning, long staple rotor spinning machines have also been manufactured only to produce coarse yarns from long staple manmade fibres.

However, wool fibres because of their scaly surface, crimp and natural greases are not possible to spin using this technique. Rotor spinning belongs to the family of open-end (OE) spinning. Open-end spinning systems are designed to overcome some of the problems associated with ring spinning. As discussed in the previous topic, twist insertion in ring spinning requires the rotation of the whole yarn package. In open-end spinning, only an end of the yarn is rotated to insert twist, which consumes much less energy than rotating a yarn package. The most successful examples of the open-end spinning concept are the rotor spinning and friction spinning systems. This topic discusses rotor spinning. Friction spinning will be discussed in the next topic. It is only logical, then, that open-end spinning will be gauged by its performance in direct competition with the older, proven, and accepted system. The rotor spinning technique is quite different from the conventional ring spinning. The differences are in the following aspects:

In ring spinning, the opened and cleaned fibre mass is converted into a strand form and a yarn is created by successive drafting and twisting at various spinning stages without disturbing the linear strand form of the fibres. Whereas in rotor spinning, the strand of fibres is first separate by vigorous drafting and is then recollected and twisted in a component of the machine called as a rotor. The feed to the rotor frame is given rarely in the form of card sliver or most commonly in the form of drawn sliver. Since rotor spinning is a true sliver to yarn conversion as compared to ring spinning where no additional roving process is required, the productivity rates are much higher; it covers less floor space and is less labour extensive. In ring spinning systems the package formation i.e. winding and twisting is an integral part of the spinning system whereas in rotor spinning, the package winding is quite separate from drafting and twist insertion. The rotor spinning produces fewer spinning faults like thick and thin places as compared to ring spinning, so rather than carrying additional winding and clearing process after spinning, the winding section of rotor frame directly produces suitable large packages required for subsequent processing with built-in clearers to remove spinning faults. This further makes the rotor spinning more economical and more productive. Instead of using the classical roller drafting, the rotor frame utilizes dispersion drafting technique.

The method of twist insertion is also different. In rotor spinning twist is inserted by the rotation of the rotor whereas in ring spinning the rotation of the traveller around the ring inserts twist.

General concept of open-end spinning

Open-end spinning is a relatively new concept of spinning. The basic principle of open-end spinning is illustrated in figure 2.5. Like ring spinning, open-end spinning involves the three basic steps of drafting, twisting and winding-on.

Drafting:

Very high draft is used to attenuate the feed sliver (not roving) into individual fibres. Such a high draft is usually by means of pinned drafting (with toothed rollers) rather than by roller drafting. Because of the direct sliver feed, there is no need to convert the sliver into roving first before spinning, which is necessary in conventional ring spinning.

Twisting

The individual fibres are collected at the yarn open-end and twist is then inserted at the yarn open-end. Since only the yarn open-end is rotated to insert twist, open-end spinning is much more energy efficient than ring spinning, which requires the rotation of a massive yarn package to insert twist. In addition, the twist insertion rate in open-end spinning can be very fast. For a given yarn twist level, this translates into fast yarn delivery speed or high production rate.

Winding-on

In open-end spinning, twisting and winding are separate operations so that yarns can be wound onto a large yarn package. In ring spinning, the package size is restricted and the yarns from the many small packages need to be joined up to make up a large package. In summary, open end spinning has the following major advantages compared to ring spinning:

- Elimination of roving stage
- high productivity and low energy consumption
- large package size Now that

Principle of Rotor Spinning

The essential feature of the rotor spinning system is the separation of the functional stages of fibre sliver opening and yarn formation, respectively imparting twist and winding up the yarn.

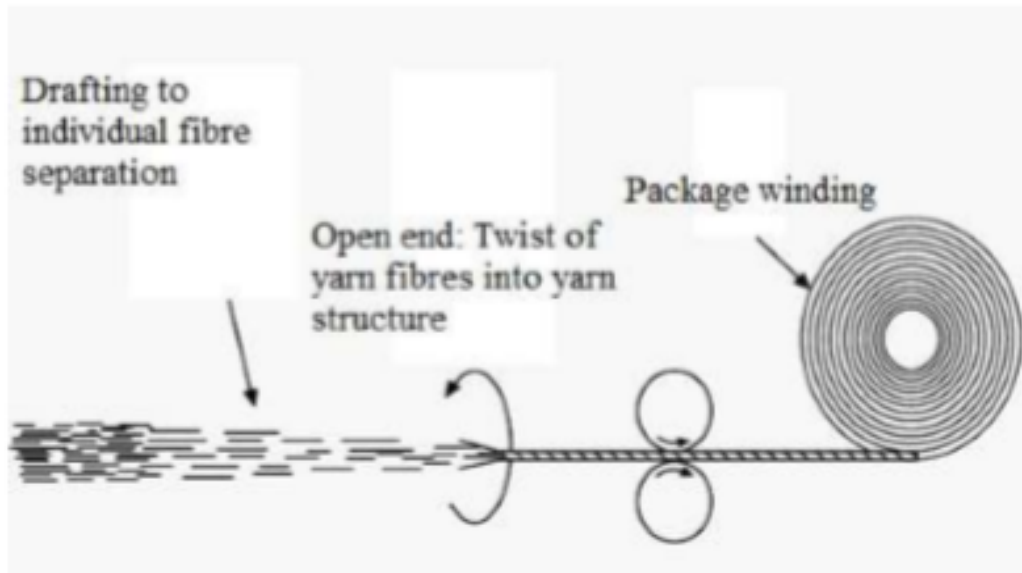


Figure 2.5 Schematic illustration of the principle of Rotor spinning

In order to achieve this fibre bundle has to be interrupted at one point at least. This occurs between the functional stages of opening the draw frame or card sliver into individual fibres and subsequently combining these fibres in the collecting groove of the spinning rotor, the twisting device of the rotor spinning system.

Since the individual fibres are released from a compact fibre bundle during transport between the opening roller and the rotor collecting groove and are only combined again in the rotor groove, we can here refer to an open yarn end.

Basic methods of open-end spinning

Although many individual OE spinning devices have been invented, they may be classified into the following groups:

- (1) Vortex assembly
- (2) Axial assembly
- (3) Discontinuous assembly
- (4) Friction spinning
- (5) Rotor spinning

Rotor spinning is an open end process which generates a genuine yarn twist. In this case the component imparting the twist is the rotor, which twists the thread around its axis. The resulting yarn twist is the decisive factor for yarn tenacity.

Functions of Rotor Spinning Process

Following are the important functions of the rotor spinning process:

Opening & Attenuation, the fibres in a sliver form are vigorously opened up into individual fibre form using opening roller having its surface covered with sharp teeth or spikes. The

vigorous opening of the fibres in this way also helps to reduce the linear density of the material. The amount of reduction in the linear density depends upon the yarn count to manufacture and can be controlled by the rate of feeding and degree of opening carried out. The drafting technique used here also called as dispersion drafting is quite different from the roller drafting technique used in ring spinning.

Cleaning, during the opening of the fibres into individual fibre form, cleaning is carried out by removing trash particle and dust particles using trash removal devices. The cleaning at the rotor spinning is optional and is only used for more dirty cotton. It is very important that fibres reaching the rotor must be free from any trash particles or fragments because they can rapidly clog the rotor causing thick and thin places, neps and uneven compactness in the yarn.

Improving Evenness, back doubling is used to make an even and homogenised rotor spun yarn. The term ‘Back Doubling’ refers to opening of the fibres in individual form and recollecting them at the rotor for yarn formation. The evenness achieved by this method is far more than that achieved at the ring spinning.

Twisting, in order to impart strength to the yarn twist is vital. Twisting is carried out by collecting the individually opened fibres and subjecting them to high speed revolving rotor.

The centrifugal forces caused because of high rotary speed of the rotor cause the fibres to get collected around the wall of the rotor in form of a yarn and with one complete rotation of the rotor, one twist is imparted.

Winding, the yarn produced by opening (drafting) and twisting is finally wound on finished packages. Unlike ring spinning where the package has lot of defects and also the size of the package is very limited due to ring / traveller arrangement, the winding portion of the rotor frame produces suitable bigger packages that can be directly used for next stage of processing

The rotor spinning process can be divided into following areas:

- (1) Feeding
- (2) Opening & Drafting
- (3) Fiber Transport
- (4) Fiber Reassembly
- (5) Twisting
- (5) Winding

Feeding Zone

The feed to the rotor machine is either done in the form of card sliver or drawn sliver. Most commonly drawn sliver of either first or second passage is used as a feeding material to the rotor frame. The sliver is fed to the opening zone with the help of a feed roller. The rotation

of the feed roller grips the fibres and presses is against the presser plate so that a controlled feed may be given to the opening zone of the machine.

Opening & Drafting Zone

The separation of fibres from sliver to individual form is critical for uniform yarn formation. If fibres are not delivered to the rotor with proper individualization, the resultant rotor yarn will lack orientation and uniformity. The opening of the fibres is carried out with the help of a rotating opening or combing roller whose surface is covered with saw teeth. As the sliver is fed in the opening region, the fibres are caught by the teeth of the opening roller. Here the centrifugal forces and the aerodynamics of the system, transports the fibres from the teeth of the opening roller to the fibre transport tube. In the fibre tube an air stream is provided that further does the opening and ultimately deposits the fibres in the rotor.

As the fibres are separated from one another, the opening roller also performs cleaning. Cleanest possible fibres should be fed to the rotor machine, however at such high degree of opening, some fine trash particles and dust will be generated. The trash extraction unit is designed so that lighter fibres are allowed to be carried away with the air stream into the fibre transport tube while the heavier trash particles will directly fall due to their weight into the trash extraction duct.

Fibre Transport

The fibres opened up by the opening roller must be transferred to the rotor without getting disoriented. This is achieved by using a specially designed transport tube. The fibres are transported by this tube with help of air currents. The transport tube is slightly tapered to accelerate the air currents and fibres so that hooked surfaces caused by teeth of opening roller may be straightened out and fibres can be oriented.

Fibre Reassembly

The fibres coming from the transport tube are accumulated inside the rotor. Rotor is the main component of the rotor spinning process. Rotor is just like a small metal cup with inclined walls having a conical shape. The inclination is essential so that the fibres coming from the fibre feed tube can slide downwards. The inner surface of the rotor is called as collecting groove. The diameter of the collecting groove also called as the rotor diameter depends upon the speed of the machine and fibre length. As a rule, the rotor diameter should never be less than 1.2 times the staple length of the fibres being processed.

Twisting

The twisting occurs with the action of rotor, navel and the take-up rollers.

Individual fibres emerge simultaneously from the fibre feed tube, they slide along the inner wall of the rotor and are collected around the collecting groove. In this way a continual fibre ring is built up in the groove and this process is called as the back doubling. As the sufficient number of fibres has reassembled inside the rotor wall, further fibre feed will choke the rotor. However rotor's special aero-dynamical design and due to excessive centrifugal forces acting on the fibres, the yarn is allowed to extend from the rotational axis of the rotor to its outer surface and ultimately carries the yarn to the navel from where it can be drawn forward with

Winding

The yarn formed at the rotor leaves the rotor spin box and is finally wound into a finished package. Unlike the ring spinning frame where the size of the package is limited because of the ring / traveller arrangement, bigger cross wound packages are produced either in form of cheeses or cones. During the process of winding spinning faults are also removed to produce an even fault free packages that require no additional processes and can be directly used for

Quality control systems

The fact that rotor-spun yarns contain significantly fewer yarn defects than ring-spun yarns has made a major contribution to the success of the rotor spinning system. A comparison of Uster Statistics shows that the numbers of thick places, thin places and neps are significantly below the level of ring-spun yarns, even at delivery speeds that are up to 10 times higher. And the finer the yarn counts, the greater the differences. The reasons for this are back-doubling in the rotor (which balances variations in mass) and fibre guidance and monitoring without a cylinder drafting system. Furthermore, a package of rotor-spun yarn contains only a fraction of the yarn joints (piecings) compared with a cross-wound package of ring-spun yarn. A 4 - 5 kg cross-wound package in the rotor spinning mill contains no more than 3 - 5 spinning- related piecing at normal ends down rates. However, a 3 kg cross-wound package of ring-spun yarn produced on the winder already contains some 30 - 40 piecings due to system-related cop joints plus a certain number of additional piecings due to cleared yarn defects. This very soon adds up to more than 50 piecings (splices or knots per package). Leading global suppliers of quality control systems (e.g., Uster Technology with the Uster Quantum Clearer2® and Barco with the Barco Profile) employ different measuring systems in some cases, but offer a largely comparable range of performance:

1. Detecting, counting and clearing disturbing yarn defects in accordance with adjustable clearing limits;
2. Counting unclear (non-disturbing) yarn defects in defect classes;
3. Detecting and eliminating extraneous substances;

4. Measuring the main physical textile yarn attributes: yarn irregularity, imperfections and Classimat values (not yarn tenacity and elongation).

2.3 Sorting production wastes

Ring Frame Waste:

At many stages of spinning process waste is removed to clear the cotton or to separate the short fibers but at the stage of ring spinning there is no need to remove waste. This step is exclusively for drafting twisting and packing the yarn in the shape of bobbin. Whatsoever material is wasted here is because of our inability to control the machine, process or processing condition. Thus to control the waste we have to control all factors.

Higher bonda waste percentage is mainly due to higher end breakage rates during spinning which depends on mechanical condition of ring frame and the quality of the material fed. Further, the amount of this waste depends on the number of spindles allotted to a tender, the number of rounds the tender takes over the spindle, and the quality of the roving feed. In practice, reducing pneumafil waste forms a regular feature of the process control activity in a mill. The different types of ring frame waste are depicted in Figure 2.6

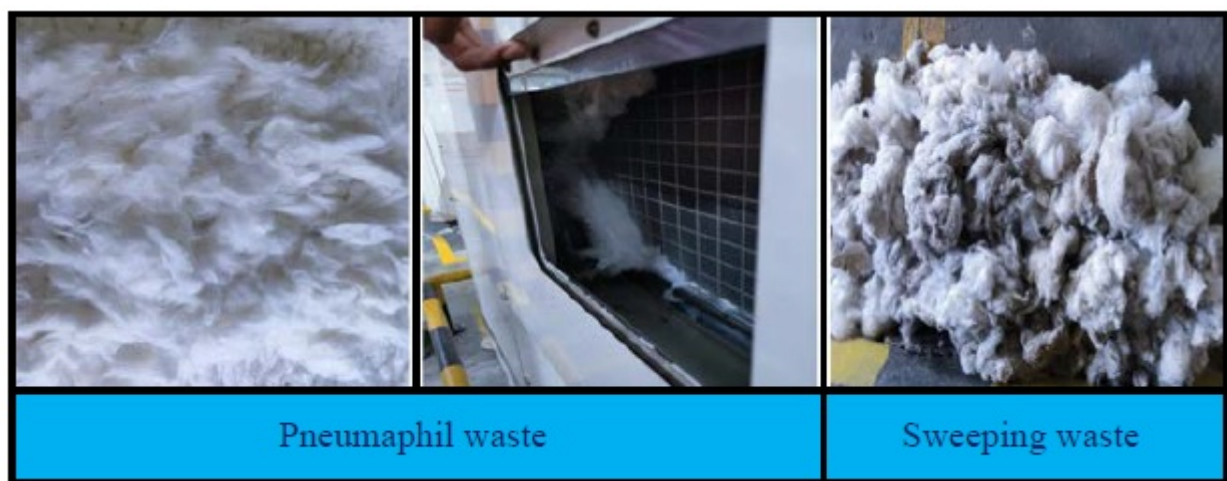


Figure 2.6: Ring frame waste extraction during spinning operation

Factors responsible for waste generation in ring frame:

1. Yarn breakage rate.
2. Time taken in attending to the yarn breakage.
3. Working practice and culture.
4. Housekeeping and material handling.
5. Mechanical breakdown and failures.
6. Methods of attending to the break downs.

Waste control in ring frame:

This is done in the following steps:

1. Analysis and segregation of the waste of different types.
2. Weigh that waste and recording that section wise, person wise, shift wise.
3. Comparison with the standards.
4. Feed backs and action to improve waste generation.

Control of Hard Waste:

Waste generated in the yarn manufacturing process can be classified into soft waste and hard waste. Reusable wastes such as sliver, lap bits, roving ends, and pneumafil waste are normally termed as soft waste. Yarn waste obtained from ring frame and winding department is not reusable, hence it is called as hard waste. The occurrence of hard waste must be controlled as it affects the productivity of the spinning mill. Hard waste generation in winding department must be less than 1%.

Waste Control in Spinning Mills:

Different types of waste in spinning mills are shown in below table.

Section	Types of Waste
Blow room	<ol style="list-style-type: none"> 1. BR Dropping 2. Kitty+Microdust 3. Metal detector 4. Heavy particle separator 5. Contamination sorter
Carding	<ol style="list-style-type: none"> 1. Flat waste+Suction hood 2. Licker-In waste 3. Kitty+Microdust 4. Sliver
Comber	<ol style="list-style-type: none"> 1. Noil 2. Sliver
Simplex	<ol style="list-style-type: none"> 1. Roving 2. Sliver
Ring frame	<ol style="list-style-type: none"> 1. Pneumafil 2. Kirchi and Lapetta (Hard waste)
Winding	<ol style="list-style-type: none"> 1. Hard waste 2. Second quality (Quality alarms)

2.4 Yarn faults

The defect of yarn is called yarn faults. When unevenness place or impurities or any other lack of minimum quality is found in a yarn is called yarn defect or faults

Some of yarn faults are:-

1. Low cop content
2. Slubs
3. Neps
4. Thick and thin places
5. Soft yarn
6. Oil stained yarn
7. Crackers

Self check-2

Page 32 of 54	Ministry of Labor and Skills Author/Copyright	Performing spinning operation	Version -1 August, 2022
---------------	--	-------------------------------	----------------------------

Test-I choice

Instruction: select the correct answer for the give choice. You have given 1 Minute for each question. Each question carries 2 Point.

- process that converts the short, raw fibre into a continuous yarn using a series of machines,
A, twisting B, winding C, cleaning D, attenuation
- slivers are reduced to around one-eighth of their original diameter by three pairs of rollers, rotating at different speeds
A, roving B, drawing C, combing D, ringing
- the basic process of reducing the tuft size of the compressed cotton fibres from a bale into smaller fibre tufts
A, opening B, cleaning C, mixing D, drafting
- an important element of the ring frame as it imparts twist on the yarn and also helps in winding the yarn on the cop
A, BCR B, traveller C, ring D, spindle
- Which one of the following is not ring frame waste?
A, pneumafil B, hard waste C, lapetta D, noil

Test II: short Answer writing

Instruction: write short answer for the given question. You are provided 3 minute for each question and each point has 5Points What are Yarn faults

- Write the main function of ring spinning.
- What is OE spinning?
- Write the use of BCR
- What are the section/zones of ring spinning

Test III: describe briefly

Instruction: write brief answer for the given question. You are provided 1ours for each question and each point has 10Points

- Describe the faults of ring spinning.
- Describe the difference between OE and ring spinning
- What is friction spinning?

Operation sheet 2

OPERATION TITLE: Operate and monitor spinning machine

Page 33 of 54	Ministry of Labor and Skills Author/Copyright	Performing spinning operation	Version -1 August, 2022
---------------	--	-------------------------------	----------------------------

Instruction: Use the given, the tools and equipment, machineries to operate and monitor machines. For this operation you have given 5 Hour and you are expected to provide the operation.

PURPOSE: to Operate and monitor spinning machine as pre the product specification

EQUIPMENT TOOLS AND MATERIALS:

Safety tools like glove, goggle safety boot

Open end spinning machine

Ring spinning machines.

PROCEDURE:

Step 1: Apply OHS practices

Step 2: Follow the steps for operation and monitoring machine operations

Step 3: Follow standard operating procedures start and stop machines accordingly

Step 4: load raw materials

Step 5: Operate machines according to specification and manufacturer requirement.

Step 6: record and report the operational fault and other problems

Step 7: clean the area and handle the waste properly

PRECAUTIONS:

The operation can be performed by following occupational health and safety rule.

- Use of proper OHS materials
- Use proper Operational workplace activities
- Use Restricted space
- Hazardous, controlled or exposed conditions
- Work may be conducted in small to large scale enterprises and may involve individual and team activities.

QUALITY CRITERIA:

Operate and monitor spinning machines and get the desired product

Lap Test-2

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, workshop, tools and materials you are required to perform the following tasks within 3 hours.

Task 1: Operate and monitor spinning machine according to the specification and product requirement

Task 2: Maintain and repair spinning machines

Task 3: Clean the area and Store waste by considering standard.

Task 4. Recognize, rectify and report machine faults or problems in production process

Unit Three: Check product quality

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Spinning product parameters
- Product faults and non-conformances
- Correction of product faults

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Understand Spinning product parameters
- Assess Product faults and non-conformances
- Correct product faults

3.1 Spinning product parameters

3.1.1 Yarn parameters

the different parameters of yarn are given below:

Page 36 of 54	Ministry of Labor and Skills Author/Copyright	Performing spinning operation	Version -1 August, 2022
---------------	--	-------------------------------	----------------------------

Yarn count (linear density of yarn)

The yarn count (linear density of yarn) expresses the fineness of the yarn. It is a number that indicates the length per unit weight or weight per unit length of yarn. There are two systems of expressing linear density or fineness of the yarn.

Direct system

In this system, the length of the yarn remains constant and the weight of the yarn varies according to the fineness of the yarn. Tex, denier, and lbs. are some examples of this system. As the count increases, the yarn becomes coarser in this system.

Indirect system

In this system, the weight of the yarn remains constant and the length of the yarn varies according to the fineness of the yarn. Ne, Nm, lea are some examples of the indirect system. As the count of yarn increases, the yarn becomes finer.

The appearance of yarn

The appearance of yarn is judged visually by naked eyes. It also plays a decisive role in the evaluation of yarn quality. How the yarn looks visually, it directly reflects in the fabric. The user should always be conducted with the appearance test of the yarn to be purchased.

An appearance board winder machine is used to see the appearance of yarn. This board has black colour on one side and white colour on another side. The yarn is wrapped onto the board with the help of a board winding machine in such a way that yarn coils should not be overlapped with each other. Now the various types of defects are observed.

The defects to be observed to decide the yarn appearance are given below:

- Neps
- Slubs
- Knot
- Thin places
- Thick places
- Hairiness
- Broken seeds
- Immature fibres
- Cleanness
- Colour

If all the above yarn regularities are minimum in the yarn, the yarn appearance will be the best.

Tensile strength of yarn

Page 37 of 54	Ministry of Labor and Skills Author/Copyright	Performing spinning operation	Version -1 August, 2022
---------------	--	-------------------------------	----------------------------

It is the most important parameter of yarn. The tensile strength of the yarn is the force required to break the yarn. The tensile strength of the yarn is a very important property of yarn. It directly affects the performance of yarn during weaving and other processes. Since yarn goes under tension during different processes of weaving and jerk applies to the yarn so that the yarn should have enough strength to bear this tension and jerk.

Yarn elongation

Elongation percentage at the time of tensile strength testing is also recorded. The elongation of yarn plays a very important role during weaving. If the yarn has no elongation, it is almost impossible to weave the fabric with this yarn. The difference between stretched lengths at the break after applying force to an original length of yarn expressed as a term of percentage is called elongation % at break. If a yarn has a higher elongation at break means it has a better ability to bear the tension and jerk during weaving and other processes

Tenacity

it is the tensile strength of the yarn. The braking force per unit linear density of yarn is called the tenacity of yarn. It is expressed as grams-force per tex (gf//tex). It gives the real tensile strength of the yarn. As the tenacity increases, the strength of the yarn becomes better.

Rupture per kilometer (R.K.M)

The length of yarn in kilo-meters” at which yarn begin to break due to its own weight when the yarn is hung vertically. It is equivalent to breaking load in grams/ tex. The yarn that has a value of RKM more than 20 is considered the best yarn.

Degree of hairiness

The degree of hairiness tells the number of fibres protruding from the base of yarn. The hairiness H measurement unit of the Uster Tester determines the hairiness of approximately 1centimetre length of yarn.

This value is specified as an average value of hairiness over the total test length. If the yarn has a 2.5 hairiness value, 2.5 centimeters fibres desist from the yarn at a yarn length of 1 centimeter of yarn. If the yarn has a low hairiness value, it means it has lower chances of the generation of pilling. It will give a better performance during weaving and other processes.

Yarn twist (degree of twist)

The yarn twist is a very important parameter. The amount of twist required to hold the fibres and yarns together depends on the diameter or size of yarns. The coarse yarn needs less amount of twist to hold the fibres together in the yarn and fine yarn needs more amount of twist to hold the fibres together in the yarn. The amount of twist or degree of twist seriously

affects the performance of yarn. If the yarn has less twist than standard then fibre slippage may occur. The yarn has a low twist possess low strength. There may be a chance of pilling formation due to low twists. It will give a soft feel and touch. If the yarn has more twists than standard. The yarn will show good strength but it will give a rough feel and touch. There may be a chance of snarling too. The amount of twist is expressed in turns/inch.

T.P.I– turns per inch in the yarn.

Type of twist: it shows the direction of the twist. There are two types of twist direction possible which are:

YARN TWIST DIRECTIONS

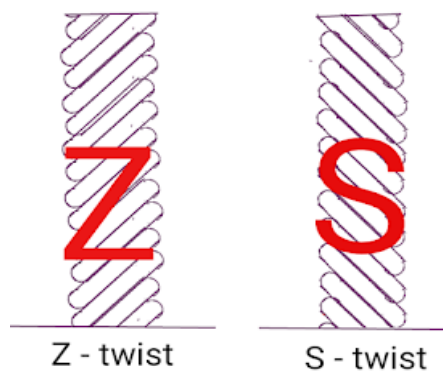


Figure 3.1 Z and S twists

S- Twist

The clockwise twist of yarn is called s-twist. The inclination of fibres in yarn looks similar to the middle part of the English letter “S”.

Z- Twist

The anticlockwise twist of yarn is called z-twist. The inclination of fibres in the yarn looks similar to the middle part of the English letter Z.

Evenness of yarn

Yarn evenness is a characteristic of yarn that denotes the level of variation in yarn linear density or mass per unit length of yarn. Evenness of yarn refers to the yarn irregularities in respect of yarn count along its length. The evenness of staple spun yarn is judged because staple spun yarn has count variation due to many reasons. The continuous filament yarn has no variation in yarn count so that evenness is not an issue for continuous yarns. The evenness of yarn is a very important quality aspect of yarn because it directly affects the fabric to be woven. Count irregularities directly appear on the fabric surface. A yarn having poor evenness has more thick and thin places along the yarn length, while an even yarn has little

variation in the count or linear density along the yarn length. Since twist tends to accumulate in the thin places in the yarn so that irregularity in yarn linear density also causes variations in twist along the yarn length. This twist variation also affects the yarn diameter. Following parameters are observed during testing of evenness of yarn:

- Uster %
- Neps
- Thick places
- Thin places
- Total imperfection

Uster%

This is a measure of the variation of linear density or count of yarn in terms of percentage. It shows the total imperfections in percentage. If a yarn has lower Uster %. It means this yarn has a lower imperfection. The quality of this yarn will be better.

Neps

A very short thick place in the yarn (a small yarn defect containing a length of 2 millimeter, the diameter of 3 times or more at a standard-setting of 200%) is called nep. It is made of unopened fibres, broken seed coated by fibres, or a trash particle. It can be + 200% thicker than the average diameter of the yarn. The increase for neps is calculated to a reference length of 1mm. They can be a bunch of entangled fibres commonly not bigger than pinball heads.

Thick place

a place in the yarn having a yarn diameter in excess of +50% of the average yarn diameter and the length 8-12 millimetres is considered as the thick place. This yarn defect affects fabric appearance.

Thin place

a place in the yarn having yarn diameter -50% or more than average diameter and any length is considered as the thin place. This is a very serious defect. Any thin place causes an end break during weaving. The number of thin places per 1000 meters should be in the range of 1- 2. A higher number of thin places create serious troubles during weaving. The productivity of the loom decreases. The fabric quality also influences.

Total imperfection

Imperfections are the total of thin, thick places and neps in 1000 meters of yarn. The yarn having total imperfection less than 100 is considered as the good quality of yarn.

3.2 Product faults and non-conformances

Yarn Faults Defects:

A yarn which is not uniform is said to be irregular or to contain yarn defects or faults. These faults vary in their cross-sectional size and length. Yarn quality is influenced by various types of yarn faults which also affects the quality of fabric produced. During the yarn manufacturing process various types of irregularities are generated in the yarn diameter regularly or at intervals which are known as yarn faults. Yarn faults are represented based on their size, length and their frequency of occurrence.

- Unevenness or irregularity
- Imperfections
- Objectionable yarn faults

“Unevenness” or “irregularity”

In all staple spun material (yarn, ravings and slivers), the fiber distribution along the material varies. The mass per unit length variation due to variation in fiber assembly is generally known as “Irregularity” or “Unevenness” (in practice the $U_m\%$ or $CV_m\%$ value). It is the skill of the spinner to arrange all machine settings in such a way that all fibers are spread as even as possible over the length of the material.

Imperfections

the extremes of variations, i.e., the thin places, thick places and neps, are usually referred to as “Imperfections”. These “imperfections” are determined according to a frequency figure or number per 1000 m or yards.

Objectionable yarn faults

If one now considers faults larger than +100% based on the mean yarn cross-section, one moves into the range of ‘yarn faults’ and correspondingly a further reduction in the frequency. Yarn defects have sizes from +100% and larger and lengths of 1 mm and longer.

Classification of Yarn Faults/ Defects

- Frequently Occurring Faults (Analyzed by Uster Evenness Tester)
- Seldom Occurring Faults (Scanned by Uster Classimat Tester)

A. Frequently Occurring Faults:

These are faults occurring in the range of 10 to 5000 times per 1000 m of yarn. Yarns spun from staple fibers contain imperfections, which can be subdivided into three groups:

1. Thick Places
2. Thin Places
3. Neps

Thick places: Cross-sectional size +30% to +100% of normal yarn with fault length ranging from 4 to 25 mm.

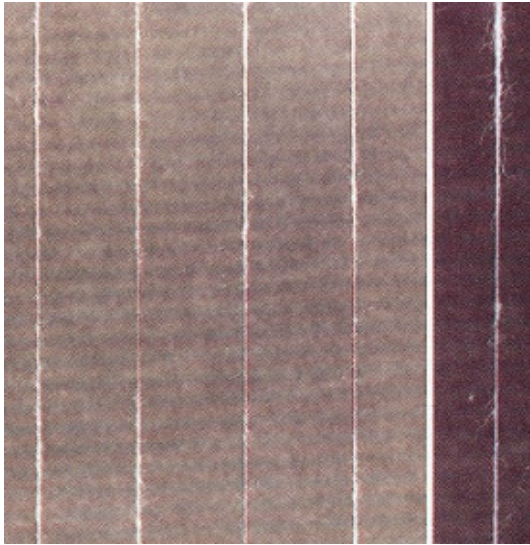


Figure: 3.2 Thick and thin places in yarn

Thin places: Cross-sectional size -30% to -60% of normal yarn with fault length ranging from 4 to 25 mm.

Neps: Neps are defined as small, tight balls of entangled fibers seen in linear textile strands.



Figure: 3.3 Neps in yarn

Thin and thick places are produced due to drafting irregularities and neps are generated due to immature fibers in raw material.

B. Seldom occurring Faults:

1. Slubs
2. Spun in fly
3. Long thin places

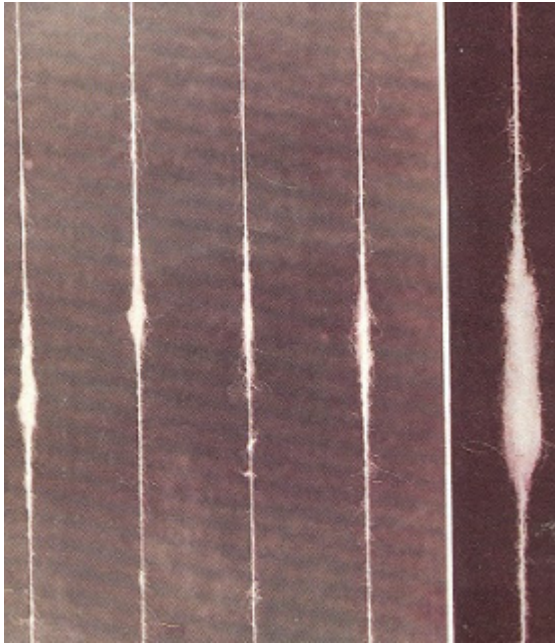


Figure: 3.4 Slubs in yarn

These are the thick and thin places in yarn which occur so rarely that spotting them would require testing at least 100,000 m of yarn. These faults may be classified further into the following types:

1. Short thick places: 1 to 8 cm and above +100%
2. Long thick places: Above 8 cm and above +45%
3. Long thin places: Above 8 cm and less than -30%

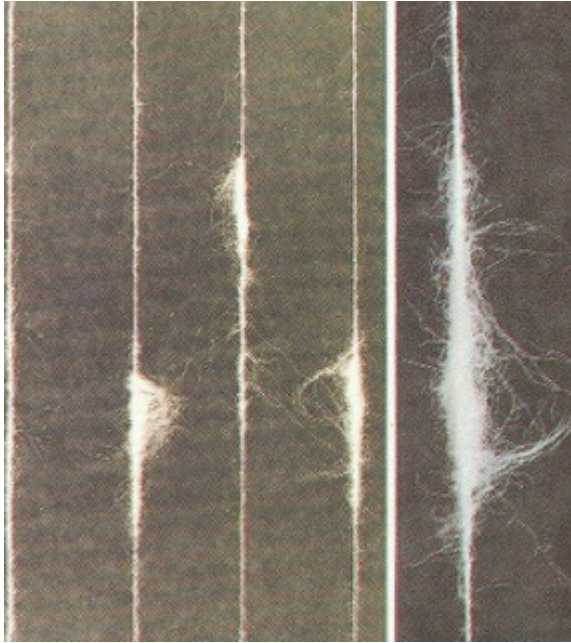


Figure: 3.5 Spun in fly
These faults are also known as objectionable faults.

Why These Yarn Faults to be Avoided?

- Causes breaks during post spinning operations.
- Detract aesthetic appeal of the fabric, if allowed to pass.

Objectionable yarn faults can be categorized in three groups:

1. Faults due to raw material
2. Faults due to piecing
3. Faults due to Spinning machine

1. Faults due to raw material: The number of objectionable faults due to raw material varies from 16% to 30% with different yarns.

2. Faults due to piecing: The number of objectionable faults due to piecing varies from 9% to 16% of the total objectionable faults.

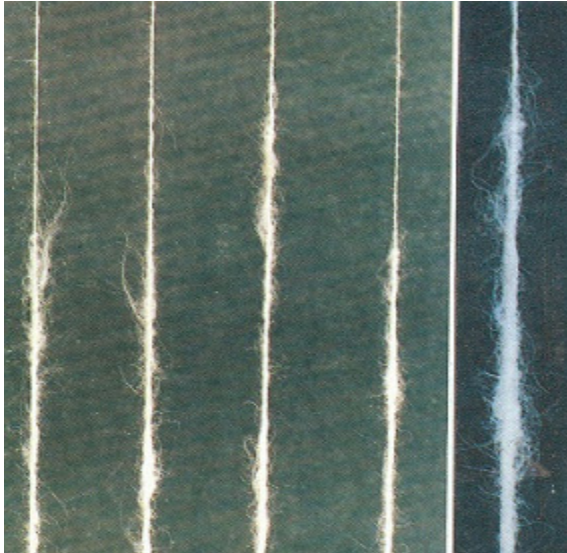


Figure: 3.6 Bad piecing

3. Faults due to spinning machine: The spinning frame (R/F) is responsible for about 50% to 60% of the total objectionable yarn defects.

3.3 Correction of product fault

Remedies of Yarn Faults:

- Machine surfaces to be maintained clean.
- Broken teeth gear wheel to be avoided and proper meshing to be ensured.
- Setting at ring frame to be maintained.
- Proper functioning of pneafil/roller clearers to be ensured.
- Removal of foreign matters (such as jute fibers, color cloth bits) to be ensured during preparation of mixing.
- Better fiber individualization at cards to be achieved.
- Correct tension weights and slub catcher settings to be employed at winding.
- Optimum twist to be used for the type of cotton processed.
- The yarn to be conditioned.
- Vibration of bobbins on the spindles to be avoided.
- Use of optimum roller settings.
- Optimum top roller pressure to be maintained.
- Use of travellars of correct size and shape and rings in good condition to be ensured.
- Optimum relative humidity to be maintained in the spinning room

Self check-3

Test I: short Answer writing

Page 45 of 54	Ministry of Labor and Skills Author/Copyright	Performing spinning operation	Version -1 August, 2022
---------------	--	-------------------------------	----------------------------

Instruction: write short answer for the given question. You are provided 3 minute for each question and each point has 5Points List at least 7 Yarn faults

1. Write the parameters of yarn.
2. What are seldom occurring faults?
3. Write the categories of yarn faults.
4. What are the remedies of yarn faults?

Note: Satisfactory rating – above 60% Unsatisfactory - below 60%

You can ask you teacher for the copy of the correct answers

Operation sheet-3

OPERATION TITLE: - Check the quality of produced yarn.

Instruction: Use the given, the tools and equipment, machineries to operate and monitor machines. For this operation you have given 2 Hour and you are expected to provide the operation

PURPOSE: to check the quality of yarns

EQUIPMENT TOOLS AND MATERIALS:

Safety tools like glove, goggle safety boot,

Yarn product

HVI or Uster tester

PROCEDURE:

Step 1: Apply OHS practices

Step 2: Follow the steps for machine operations

Step 3: Follow standard operating procedures

Step 4 Ready or set up testing equipments

Step 5: Check the quality of produced yarn according to the specification

Step 6: record and report the operational fault and other problems

Step 7: clean the area and handle the waste properly

PRECAUTIONS:

- Use proper OHS practices
- Apply correct Operational workplace activities
- Use Restricted space
- Hazardous, controlled or exposed conditions
- Work may be conducted in small to large scale enterprises and may involve individual and team activities.

QUALITY CRITERIA:

Check yarns as per the specification

Lap Test-3

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, workshop, tools and materials you are required to perform the following tasks within 2 hours.

Task 1: Check product quality using standard and manufacturer requirement.

Task 2: Assess yarn faults and Report to the concerned body.

Unit Four: Complete operations

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Principles of doffing and replacing

- Product handling and dispatching system
- Production records and documentation

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Understand Principles of doffing and replacing
- Apply product handling dispatching
- Record and document the products

4.1 Principles of doffing and replacing

A method for automatic cop doffing in a spinner having a plurality of pliers for gripping the reels or cops and the yarn winding up spools, said pliers being carried by a plier-carrying bar, vertically and horizontally movable supported between one bottom position thereof adjacent a conveyor belt for feeding the spools and unloading the cops, and at least one top position relative to the spindle-carrying frame of said spinner, wherein a provision is made for moving said pliers-carrying bar to a top position with said pliers arranged at a closest location as possible to the bottom end of said cops; clamping the pliers by gripping the cops at the bottom end thereof firmly pressing the last coils of wound up yarn; lifting the cops by a distance sufficient to tear the thread within the length between the gripping location for one

pliers on the cop and a thread supply previously wound up on the spindle underlying the spool; and finally doffing the cop from the spindle and replacing it with a spool.

Automatic doffing

There are two types of automatic doffing for ring-spinning machines: stationary and travelling devices; the former is mostly used in new machines. After completion of a doff, the doffer, which contains empty ring bobbins and also the provision for holding the fully wound bobbins, rises from below. Fully wound cops are then gripped by the doffer and transferred to it, and then empty bobbins are transferred from the doffer to the spindle of the ring-spinning machine. Subsequently the doffer comes back to its original position and transfers all the full cops to a conveyor belt, which might be used to transfer them to the winding machine.

4.2 Product handling and dispatching system

Handling and dispatching procedure of yarn

- unloading of the yarn
- The store helpers under the supervision of store officer shall unload the yarn upon receiving in yarn store.
- During unloading the store helper shall use the protection such as air musk and other safety device. In plastic bags or covered to protect, clearly identified. on palettes or racks.
- Where racking is used there must be clear pathways to allow for easy access.
- Where raw materials are stored at a height, lockable step ladders must be provided.
- Documented Stock records
- All 'Organic' & 'Fairtrade' yarn must be stored separately from other standard yarns.
- Raw materials, packaging and equipment must not be stored outside.
- Where this is unavoidable, materials must be stored so that there is no risk to the product from any form of damp, damage, soiling, contamination or pests. Product must be fully inspected prior to transfer to the correct raw material storage area.
- The helper shall unload the yarn and store in the designated area for yarn store.



Figure 4.1 spinning product (yarn)

4.3 Production records and documentation

- ☐ Documentation: information created in order for the organization to operate
- ☐ Records: evidence of results achieved

Document Control

Measures shall be established to control the issuance of documents, such as instructions, procedures, and drawings, including changes thereto, which prescribe all activities affecting quality. These measures shall assure that documents, including changes, are reviewed for adequacy and approved for release by authorized personnel and are distributed to and used at the location where the prescribed activity is performed. Changes to documents shall be reviewed and approved by the same organizations that performed the original review and approval unless the applicant designates another responsible organization.

Quality Assurance Records

Sufficient records shall be maintained to furnish evidence of activities affecting quality. The records shall include at least the following: Operating logs and the results of reviews, inspections, tests, audits, monitoring of work performance, and materials analyses. The records shall also include closely-related data such as qualifications of personnel, procedures, and equipment. Inspection and test records shall, as a minimum, identify the inspector or data recorder, the type of observation, the results, the acceptability, and the action taken in connection with any deficiencies noted. Records shall be identifiable and

retrievable. Consistent with applicable regulatory requirements, the applicant shall establish requirements concerning record retention, such as duration, location, and assigned responsibility.

Briefly stated:

Document control is the process used to maintain documents that control the design, operation, maintenance, and configuration of the site.

Records are the process for providing evidence of those activities.

Self check-4

Test I: short Answer writing

Instruction: write short answer for the given question. You are provided 3 minute for each question and each point has 5Points

1. What is doffing in spinning
2. Write the procedures for handling and dispatching of products.
3. What are the uses of record and documentation

Note: Satisfactory rating – above 60% Unsatisfactory - below 60%

You can ask your teacher for the copy of the correct answers

Operation sheet-4

OPERATION TITLE: Complete spinning operation

Instruction Use the given, the tools and equipment, machineries to operate and monitor machines. For this operation you have given 8Hour and you are expected to provide the operation

PURPOSE: to complete spinning operations

. EQUIPMENT TOOLS AND MATERIALS:

- Safety tools like glove, goggle safety boot
- open end spinning
- ring spinning ,
- handling materials(trolley racks plastics etc)

PROCEDURE:

Step 1: Apply OHS practices

Page 53 of 54	Ministry of Labor and Skills Author/Copyright	Performing spinning operation	Version -1 August, 2022
---------------	--	-------------------------------	----------------------------

Step 2: Follow standard operating procedures

Step 3: Follow the steps for completing pre spinning operations

Step 4: Unload products

Step 5: dispatch products

Step 6: record and report the operational fault and other problems

Step 7: clean the area and handle the waste properly

PRECAUTIONS:

- Use of proper OHS materials
- Operational workplace activities
- Restricted space
- Hazardous, controlled or exposed conditions
- Work may be conducted in small to large scale enterprises and may involve individual and team activities.

QUALITY CRITERIA:

Complete spinning operation efficiently

Lap Test-4

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, workshop, tools and materials you are required to perform the following tasks within 3 hours.

Task 1. Doff and replace spinning products.

Task 2 Unload and dispatch products to the next processes according to the standard.

Task 3 Complete cleaning and maintaining the work environment in a safe manner.